

POSSIBLE SCENARIO FOR VOIP COLLABORATION SOLUTION IN RAILWAY ENVIRONMENT

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Abstract – Collaboration solutions for corporate level are transforming and migrating, taking the best possible properties from all the contemporary ICT solutions have to offer. Railway companies consisting of infrastructure/freight/ passenger subdivisions could potentially benefit from all the collaboration vendors are implementing. Multiple transmission and communication platforms integrated in both administrative and traffic domains in railways are changing and it is sometimes unclear are railway applications loosing in this race. Scenario discussed in this paper could indicate a long-term platform evolving at the needed rate, overcoming hybrid periods easily, day-to-day migration of employees and divergence in personnel distribution.

Keywords – railway telephony systems, cloud-based solutions, unified communication.

1. INTRODUCTION

Communication between railway staff is crucial in traffic management and has always had an important position in the regulations for the exact definition of communication rules, both in domestic and international communication, at border crossings [1,2]. Of course, modernization and technical-technological innovations had to affect this segment of telecommunications as well. The question arises to what extent the VoIP systems should be interleaved with other communication technologies in railway, and whether there is a limit that should be set in order to ensure reliable and controlled communications.

2. VOIP IN RAILWAY ENVIRONMENT

Generally speaking, in railway traffic, VOIP communication exists between the staff along the track and the dispatcher, between the dispatchers themselves, between the train driver and the dispatcher, between the track workers and the dispatcher by all possible systems.

Many systems are defined as closed systems, i.e. systems that do not communicate with other systems, and are also implemented as systems with their own

transmission systems. The modernization of the transmission system led to the migration of various services into a single transmission system.

Another system, MPLS (Multiprotocol Label Switching), enables high speeds with redundant links. This can set the first level of modernization of the VoIP system, i.e. the traditional relay systems (Fig.1), on old transmission systems can be replaced with a classic TCP/IP based server structure with corresponding transmission systems with enough capacity for evolving services.

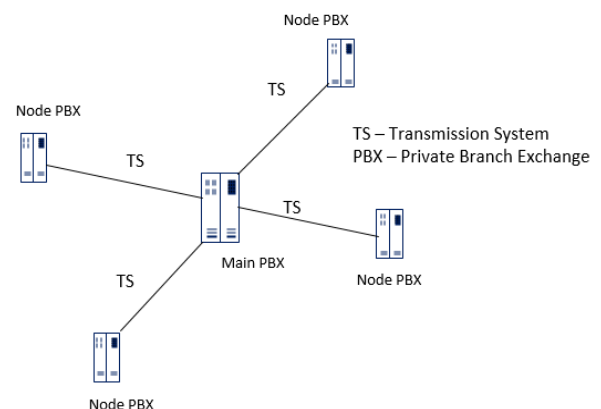


Fig.1. Starting point with old systems

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The VoIP system organization principles, the definition of the transit exchange, the main exchange (Private Branch Exchange PBX) and the node PBX, still, remains defined for the reason that the entire network could not immediately switch to MPLS connectivity [3]. Switching the entire network to MPLS involves the entire optical structure along the railway, which is essentially a large investment.

The next level of VoIP system development is directly dependent on the development and expansion of the transport system. In order to ensure higher speed, connectivity and redundancy for locations, where the nodal PBX is located, the introduction of advanced systems such as L3VPN (Level 3 Virtual Privet Network) as well as IPsec (IP Security) tunnels over a standard Internet link is mandatory (Fig.2.). If these two options are included, for stations/locations that do not have MPLS connectivity, a good option would be to install SD-WAN (Software Defined Wide Area Network) technology. A model of such a connection is given in the Fig.3.

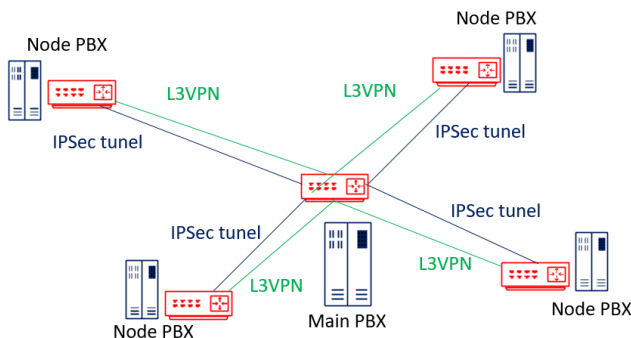


Fig.2. Second phase, with redundant links and old PBX network

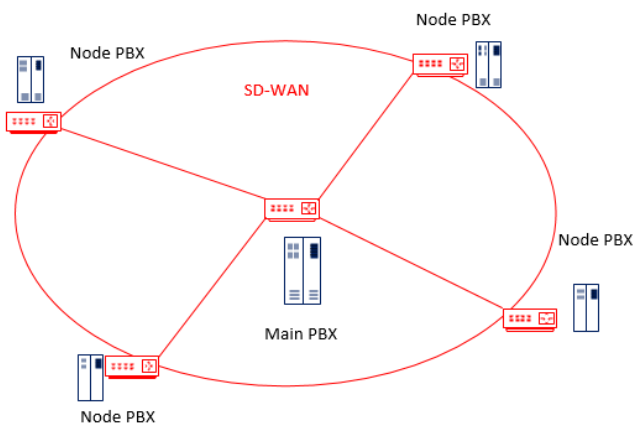


Fig.3. Third phase with SD-WAN

With the installation of SD-WAN technology, network will reach a point when all node VoIP PBX could be migrated from the classic relay technique to standard server systems. As can be assumed, the system could still function according to the old numbering plan, all communication between the centers would be done through new connections. Services that were isolated in their own networks can

now be routed through separate VLANs/VRFs (Virtual Local Area Network/ Virtual Routing and Forwarding) and can also be isolated, i.e. function according to the old principle.

The following figure (Fig.4). shows a diagram of the possible connectivity of locations with all modes of transmission.

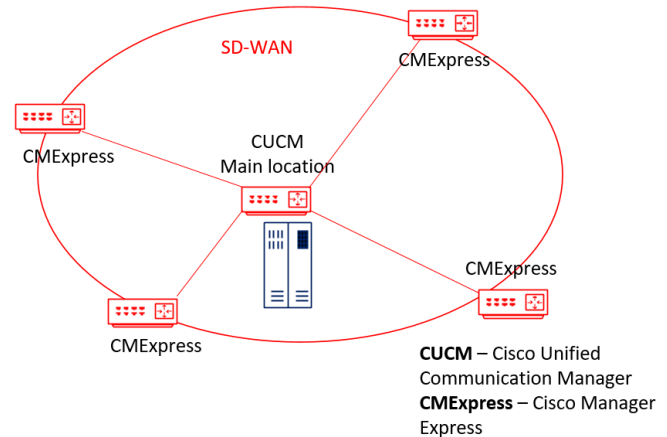


Fig.4. Network after all the phases.

So, VoIP solution should be done with:

- excessive assessment and planning – with detailed current system analysis, requirements gathering (sometimes managers are unaware of all possibilities), defining scope and objective, risk assessment
- design phase – prolonged because of the incomplete transmission network, architecture design (clustering, call routing policies, numbering plan...), and in some cases integration with existing systems using all possible interfaces (FXS/FXO Foreign Exchange Subscriber/Foreign Exchange Office)
- testing with proof of concept – test environment setup, interoperability testing, failover and pilot sites
- deployment – being in various forms as phased rollout (from edges to main location), coexistence and cutover
- monitoring, with various maintenance scenarios
- integration to overall disaster recovery plan for railway network
- integration, as much as possible, with specific railway systems (PA- Public Address, dispatching if regulations allow for this type of integration, technical protection systems...).
- excessive training and documentation (throughout the planning, implementation, deployment, testing and all following steps).

3. EXPECTED NETWORK CHARACTERISTICS

Introducing SD-WAN technology to all locations, which would have redundant links to the main VoIP location, space is opened for the partial abolition of the creation of a system where VoIP network will be done according to installation and commissioning dictated by the vendor (virtualization, clustering, active/active, active/passive...)[5]. This paper will use the well-defined principles for explanation of the possible solution based on Cisco Unified Communication Manager solution (CUCM). CUCM is a platform with multiple possibilities with one main function – call manager. One of the reduces variant is an CM Express being a solution for locations with small number of subscribers. Mentioned solutions for telephony networks are always including Survivable Remote Site Telephony as good variant if migration from legacy telephony is in focus.

All vendors have similar solutions, providing localized calls, mobility and conferencing. This specific vendor has it on ISR (Integrated Services Router) [5].

Node (lower level location) could thus be realized with a full or reduced solution. However, main location must be supported with full capabilities CUCM (Fig.4). Main locations are nowadays mainly virtualized, which is also used in case of CUCM. It runs on so called Cisco flavor of Linux.

Adding some additional equipment to CUCM could support Mobile and Remote Access (MRA) with firewall traversal solution [5].

Fig.5. [6] shows such solution.

One of the main disadvantages of such a system would be the maintenance. Maintenance personnel must be fully educated to work in computer networks as well as special training for VoIP systems. Another problem, which should not be ignored, would be the hardware of the VoIP system itself.

System hardware has a predictable and significantly determined lifetime. It should also be considered, that if migration is done, the virtualization and storage solutions must be supported in order to have the option of working in two locations at the same time.

Cloud-based solution could also add another dimension for clients (WebEx) [5].

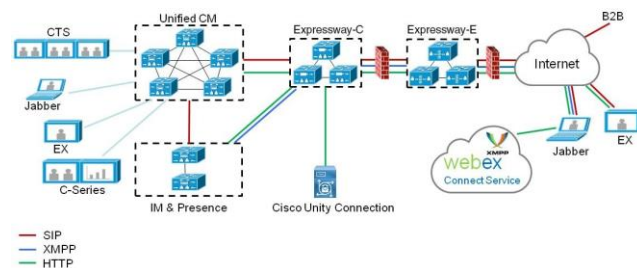


Fig.5. CUCM solution with Instant messaging and Presence, Expressway, WebEx, including various endpoints [6]

4. CONCLUSION

The collaboration solutions must enable all the standard communication services contemporary work environment provides. This should be accompanied with railway specific services that could (according to regulations and possibilities) be integrated in such a network.

This VoIP based network must be realized in phases according to railway road plan. One of the first prerequisites of VoIP network is a fully functional transmission network. Most of the main lines are planned for such a outcome.

Presented solution could benefit from all vendor's additions to this particular system – IM&P, cloud solution (WebEx), Expressway, etc.

Collaboration solution discussed in paper is especially beneficial for nomadic employees in railway environment. Integration of VoIP solutions with existing network could group maintenance personnel, but will also increase the level of training and education needed for this personnel. This is the most controversial issue arising from this migration. Unified communication aspect is just addition on already vast pool of services.

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